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## The ferns and flowering plants of Nantucket — III

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Since Part II of this paper was published, a visit was made to Nantucket, from June 7 to 20, for the purpose, primarily, of investigating the earlier *Carices*. Previous visits, always in the late summer and autumn, had necessarily missed those sedges which, after their flowering and fruiting period in the spring and early summer, may no longer be recognized. The *Carex* season on Nantucket, therefore, promised to be of more than ordinary interest, especially as the list of species credited to the island was manifestly far from complete. The event disclosed no less than thirteen *Carices* not previously met with, all but one of which were additions to the island's known flora.

Another interesting outcome of this visit was the addition of ten grasses to those previously enumerated. In this group, also, many new observations were made. The record of these may be deferred to an appendix, but, for the purpose of preserving the general sequence of species as far as published, the additions are here interpolated.

It follows from this visit to Nantucket in June that the remainder of this paper will not accord strictly with the statement made in the introduction that it is based solely on explorations conducted in the late summer and autumn. In general, however, this will remain true, and all facts derived from observations made exclusively in June will be so indicated in the text.

In connection with these observations it should be recorded that the spring season of 1908 on Nantucket was a very late and

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backward one and that in May and June the island suffered from a protracted drought. My explorations found the ponds lower and the bogs drier than the experience of other years had ever found them to be, even at the end of summer.

## GRAMINEAE (concluded)

In Part II. it was said that the number of grasses known to occur on Nantucket, exclusive of several well-marked varieties, was one hundred and four. This number may now be increased to one hundred and seventeen. Three common species unaccountably omitted from Part II. are here added.

CALAMAGROSTIS CANADENSIS (Michx.) Beauv.

In bogs everywhere; panicles dried by the end of August.

CALAMAGROSTIS CINNOIDES (Muhl.) Scribn.

Somewhat local but rather widely distributed; most common in the neighborhood of Tom Never's Swamp and in the "Woods." In full flower through late August and September.

AMMOPHILA ARENARIA (L.) Link.

Abundant, occurring in sandy places all over the island, even on Saul's Hills. In full flower through August and September.

Extreme forms of this grass show a marked divergence in the characters of the spike and flowers. The spike may be long and tapering, 3.5 dm. long and 1.5 cm. thick, the spikelets with narrowly attenuate and acute outer glumes becoming 1.5 cm. in length; or it may be linear-cylindric, the outer glumes puberulent, much less gradually attenuate, acutish or obtuse, and only 7–10 cm. long.

* ALOPECURUS GENICULATUS L.

Frequent in wet places in the meadows north of the town and along damp sandy cartways below the "Cliff." Just in full flower June 7, but many spikes immature.

This is the introduced plant as distinguished from the native *A. aristulatus* of Michaux. The latter plant seems to have been well understood by some of the fathers of our botany but to have almost fallen from recognition of late years. I do not think there need be any doubt that it is worthy of its old position. It is a more delicate grass than *A. geniculatus* and offers an immediate contrast by its glaucous character and paler green color. It is

further much less stiffly depressed and geniculate, or even erect, with longer, thinner leaves, having less inflated sheaths, and longer, more slender spikes of much smaller shorter-awned flowers. The glumes and flowering scales are also somewhat different in form and proportions. An obvious difference between the two plants at their flowering periods is the relative size and color of the anthers: in *A. geniculatus* they are often purple and are 1.5–2 mm. long, in *A. aristulatus* they are yellow and only one third that size.

There would seem to be a considerable difference of time between the flowering periods of these grasses, since *A. aristulatus* was found this last season at the Thousand Islands in full flower late in September.

ALOPECURUS PRATENSIS L.

Common and well established, mainly in fields and lots in the general town region; west to beyond Maxcy's Pond; east to Monomoy and Shawkemo, then in Polpis towards Quidnet; 'Sconset. Just in full flower June 7.

* AGROSTIS ALBA ARISTULATA A. Gray.

Pocomo, in sterile soil far from any cultivated ground. In full flower June 15.

Slender but rather stiff, in loose tufts; culms 1–2.5 dm. high, erect, mostly geniculate close to the base, the basal leaf-sheaths broadened and chaffy; leaves very narrow, erect, involute; panicles purplish, 2–10 cm. long, very narrow, with erect or erect-ascending short branches; outer glumes 1.75–2 mm. long, lemma 1.5–2 mm., palet .75–1 mm.; awns 2–3 mm. long, wanting in many flowers on some panicles.

A distinct-appearing grass needing critical study.

* **Agrostis antecedens** sp. nov.

Common in dry sandy places or sometimes in damp soil. In full flower June 7.

Erect, tufted or of somewhat scattered habit, mostly 1.5–2 dm. high (1–6 dm.), pale green, much tinged with purple; culms often slightly geniculate at the lower nodes; leaves slightly scabrous, short, erect, involute-filiform, mostly 2–6 cm. long, or, in stout forms, larger and flattened, becoming 1–2 mm. wide and 10 cm. long; ligule blunt or acute, lacerate, 0.5–4 mm. long; sheaths smooth or slightly roughened, shorter than the internodes;

panicle purple, at maturity more or less exserted, sometimes for 12 cm., the very rough branches erect, erect-ascending or slightly spreading, 1–2 dm. long, borne in whorls of 3–11 on the lower nodes and of 2–5 above; the internodes 2–4.5 cm. in length; branches 6–12 cm. long, branched usually well above the middle or towards the ends; spikelets clustered towards the ends of the short branchlets, mostly very short-pedicelled or some even subsessile; empty glumes 1–2 mm. long, subequal or unequal, acute to abruptly acuminate, scabrous on the keel; lemma 0.5–1 mm. long, blunt.

Type deposited in the herbarium of the New York Botanical Garden.

Closely related to *Agrostis hyemalis*, with which it has hitherto been confused, but differing in many essential points. *A. antecedens* is a much smaller plant than *A. hyemalis*, commonly not over half the size, with much shorter and narrower involute leaves, their sheaths much shorter instead of longer than the internodes. In *A. hyemalis*, the ample diffuse panicle is ordinarily more or less included at its base and is often more than half the length of the entire plant; in *A. antecedens*, it is relatively much shorter, more or less peduncled, and differs further in relatively much shorter, less widely spreading branches, which are less numerous in the lower whorls and more numerous from the middle ones. In *A. hyemalis*, the branches are commonly branched at or below the middle; in *A. antecedens*, well above the middle or towards the end; also, the ultimate flowering branchlets are much shorter than in *A. hyemalis* and the flowers, which are on much shorter pedicels, are manifestly smaller and more clustered; the empty glumes are commonly less unequal, relatively broader and less tapering, but more acuminate, the scabrous dorsal nerve less pronounced, the lemma shorter and less acute, but relatively longer as compared with the empty scales.

The distinctness of the two plants is further attested by their different flowering periods, *A. antecedens* being primarily a grass of the spring and early summer, *A. hyemalis* of the midsummer and fall. Both species are common on Long Island, where *A. antecedens* comes into flower from the middle of May to early June and is in its prime by the middle of the latter month, although sometimes persisting into September, while *A. hyemalis* begins to bloom rarely earlier than July and may be found freshly in flower as late as mid-November.

On Nantucket, on June 18, both species were found growing in actual contact, *A. antecedens* being at the height of bloom, *A. hyemalis*, although larger throughout and much more leafy, not yet showing the first signs of flowering.

* SPHENOPHOLIS PALUSTRIS (Michx.) Scribn.

In a corner of Watt's Run Bog, June 15, growing rather sparingly but of full development, the most advanced plants just in flower. Lower sheaths pubescent; plant perfectly typical as distinguished from var. *flexuosa* Scribn.

* DANTHONIA COMPRESSA Austin.

Along a cart-path through a damp thicket in Squam, June 15; first flowers, but panicles not yet fully expanded.

POA TRIVIALIS L.

Very common generally; in full flower June 7.

* PUCCINELLIA DISTANS (L.) Parl.

Common along dry or damp clayey roadsides towards Brant Point and below the "Cliff," often in close association with *P. fasciculata*. In full flower June 7; overmature and mostly dried up and little noticeable by June 18.

The plant seems rather ambiguous in some of its characters as between *P. distans* and *P. airoides* (Nutt.) Wats. & Coult.

FESTUCA DURIUSCULA L.

Occasional in sandy lots and by roadsides on the outskirts of the town; in full flower June 8.

Taller than *Festuca ovina*, with puberulent leaf-sheaths and larger panicles, the flowering scales larger, sometimes almost hirsute-pubescent and longer-awned. This plant is referred to *F. duriuscula* on the strength of presumably authentic European specimens. It would seem to have been generally lost sight of in our manuals that the original description of this grass calls for hispid flowering scales — "spcis * * * hispidis" (Sp. Pl. 74. 1753).

BROMUS STERILIS L.

At a number of places by street-sides in the town, sometimes in abundance, as along Pleasant Street. In full flower June 7.

LOLIUM PERENNE L.

Frequent or common in the town and occasional at outlying points; 'Sconset. Just in flower June 7.

Mrs. Owen's record of this grass, which, it was thought, might perhaps have referred to *L. italicum*, is thus confirmed.

* AGROPYRON REPENS PILOSUM Scribn.; Rand & Redf. Fl. Mt. Des. Isl. 183. 1894; U. S. Dept. Agric. Div. Agrost. Bull. 4: 36. 1897.

Sandy shore of the harbor towards Brant Point and adjacent roadsides; in full flower June 20. Plant conspicuously bluish green and glaucous, in other respects agreeing precisely with Scribner's descriptions and appearing very distinct from the ordinary forms of *A. repens*.

* HORDEUM JUBATUM L.

A single vigorous cluster by a neglected street-side near the old wharves; spikes almost fully expanded June 12.

## CYPERACEAE

As with the Gramineae, it is to be understood of the species in this family that they were found in mature condition from the middle of August until the middle of September unless it is otherwise stated.

CYPERUS DIANDRUS Torr.

Frequent in damp sandy places and low grounds.

* CYPERUS RIVULARIS Kunth.

Uncommon, growing with *C. diandrus* at two localities near the town and on the shore of Miacomet Pond.

CYPERUS NUTTALLII Eddy.

Very common in salt marshes and on the sandy shores of brackish ponds.

CYPERUS DENTATUS Torr.

Common, occurring at many localities in sand or sandy soil, especially on pond shores; occasional in dry places along roadsides. In great profusion at Tom Never's and Gibbs' ponds and about ponds on the south shore; Maxcy's Pond; Capaum Pond; Long Pond; not seen in northeast quarter.

In seasons favorable to its growth this species on Nantucket attains a very full development, the inflorescence becoming unusually broad and compound, with spikes 15–35-flowered and 8–16 mm. in length (var. *ctenostachys* Fernald, Rhodora 8: 126,

127. 1906). Under conditions in which its flowering vigor becomes impaired the plant takes on a remarkably different aspect by reason of much shortened spikes, and scales often of darker color and with more spreading tips. A few extreme examples of this reduced state were collected, showing many spikes not more than 5–7-flowered and only 3–5 mm. long, although occasionally an elongated, many-flowered spike was developed among the shorter ones on the same axis. This condition of reduced flowering vigor seems often to result from an increased vegetative impulse supplied by a very rich or a very wet soil. Under such conditions the inflorescence is often invaded by a vegetative tendency whereby some of the spikes become more or less proliferous or even wholly transformed into tufts of small leaves.

I have collected on Long Island rather a marked form of the longer-spiked state of this plant, in which the spikes were narrower than in the Nantucket plant, with more numerous and crowded, much shorter scales.

CYPERUS ESCULENTUS L.

Common in cultivated and neglected fields and roadsides. Along the sandy banks of the railroad near the town, on Aug. 28, 1904, were many stout plants bearing wide-spreading umbels with rays 10–14 cm. long and clusters of spikes 6 cm. across, the narrowly linear spikelets being about 1.5 mm. wide and becoming 2.5 cm. long. At the same place in 1906 the ordinary short-spiked state of the plant was alone found. This form of the plant with elongated spikes would ordinarily be referred to var. *angustispicatus* Britton or var. *leptostachyus* Boeckl., but there is a rarer and more distinct plant with the spikes paler in color and almost filiform-linear to which, perhaps, the name more particularly applies. At any rate, the long-spiked Nantucket plant would appear to be scarcely more than a state of the common species, illustrating that occasional elongation of the flowering axis to which so many of the Cyperaceae are subject.

* CYPERUS SPECIOSUS Vahl.

Rare; sandy shore of Sachacha Pond, Sept. 16, 1899 and Aug. 13, 1906, — a few dwarf plants 5–9 cm. high, with subsessile capitate spikes.

CYPERUS STRIGOSUS L.

Infrequent; in low grounds. The stout form of the plant (var. *robustior* Kunth) at Eatfire, with spikes 4–5 cm. thick and spikelets 2 cm. long.

* CYPERUS STRIGOSUS COMPOSITUS Britton.

Common in low grounds; spikes cylindric, dense, 2–3 cm. long, 1–2 cm. thick, usually of a brighter, more yellowish brown color than in *C. strigosus*. A well-marked plant, having claims to recognition as a distinct species.

*Cyperus erythrorhizos* Muhl. was recorded by William Oakes as having been found on Nantucket in 1829 (Hovey's Magazine, May 18, 1849, 219, 220). That the plant has not since been found on the island would not of itself be an adequate reason for not giving it a more formal place here. It so happens, however, that the species is closely counterfeited in appearance by forms of *Cyperus strigosus compositus*, so closely indeed, that when, recently, at the herbarium of the New York Botanical Garden, a specimen of the latter was laid on a sheet of *Cyperus erythrorhizos* it was remarked by a very high authority on the genus, that, at a little distance, the two specimens looked as if they might have grown from one root; without particular reference, therefore, to the scale characters and minuter anatomy one plant might easily be mistaken for the other, and in view of the possibility of this, remote though it be in the case of a record by Oakes, a rediscovery of the plant on Nantucket would be at least a reassuring event.

**Cyperus macilentus** (Fernald) comb. nov.

Everywhere in dry sandy soil, even at the highest points on Saul's Hills.

Professor Fernald has recently called attention (Rhodora 8: 128, 129. 1906) to the very obvious differences between typical *Cyperus filiculmis* Vahl and this plant of smaller spikelets and more northern distribution, separating it as var. *macilentus*. I have long regarded these plants as distinct or so nearly so that, whatever their precise relationship might be, it was to be expressed no more accurately by a trinomial than by a binomial designation.

CYPERUS GRAYI Torr.

In pure sand on dunes and wastes, frequent or rather common.

DULICHIUM ARUNDINACEUM (L.) Britton.

Fresh-water ponds and wet swamps ; very common.

* ELEOCHARIS OBTUSA Schultes.

Uncommon or rare and met with at only four stations : Cato's Pond ; roadside west of the town ; Pocomo ; pool by state road near 'Sconset. It appears to come into flower on Nantucket later than its normal flowering time in the same latitude. In 1889, 1904, and 1907, its most advanced heads were perfectly fresh at the middle of September ; in 1906, when observations did not extend beyond the middle of August, it was not seen at all.

ELEOCHARIS PALUSTRIS (L.) R. & S.

Common in the muddy borders of ponds and pools. Just in flower June 7 ; spikes dried after the middle of August.

* ELEOCHARIS GLAUCESCENS Willd.

In wet sand about the borders of Madequecham and Nobadeer Ponds on the south shore and Capaum Pond on the north shore, also in an overflowed muddy place in Quaise. In full flower June 15 ; in flower and fruit Sept. 2, 1904.

In wet sand the culms are extremely slender, even capillary, sometimes spreading or almost prostrate and only 5–15 cm. long ; in water or wet mud it becomes stouter, strictly erect, and sometimes 50 cm. tall.

Although this plant has received only scant recognition in our flora, even as a mere variety of *Eleocharis palustris*, I have little hesitation in restoring it to specific rank.

In *E. palustris*, the narrowly ovoid, usually tapering spikelets are 10–20 mm. long and arise between two opposite scales which terminate and are continuous with the culm ; in *E. glaucescens*, there is only one such scale and the smaller ovoid spikelets, 3–10 mm. long, receiving therefore unequal lateral support at the base, are often slightly oblique or may be easily deflected ; the scales of the spikelet are looser and less numerous than in *E. palustris*, in much fewer rows, broader and more concave, much deeper and brighter purplish brown in color, and usually quite without the green mid-vein often so conspicuous in the spikelets of *E. palustris*. The achene of *E. glaucescens* is usually slightly larger than in *E. palustris*, notwithstanding the smaller size of the plant, with slightly

longer and more conic tubercle. The sheaths in *E. glaucescens* are less striate than in *E. palustris*, the lower ones more shining and of a brighter purplish red color, the upper one much less oblique at the top, sometimes even quite truncate, and the cortex of the culm under a lens much more distinctly crystalline-punctate and more coarsely cellular. The anthers and stigmas of *E. palustris* are definitely longer and more slender than those of *E. glaucescens*. These observations were made by comparison of living plants on Nantucket and are confirmed by fresh specimens from Long Island also and by some general reference to herbarium material.

ELEOCHARIS ACICULARIS (L.) R. & S.

Frequent or common in wet places. In full flower in August and September; not observed in June.

* ELEOCHARIS TRICOSTATA Torr.

Almanac Pond, Sept. 19, 1907 — a considerable growth on the muddy shore, where the water had receded, the culms and spikelets in all stages of development from their earliest visible condition up to full maturity. A few yards away a dense growth of *Eleocharis palustris* covered the muddy level, but the two species were not found intermingling. At the same place, on June 18, was an abundance of *E. palustris* in full flower, but *E. tricostata* was not sufficiently advanced to be recognizable.

ELEOCHARIS TENUIS (Willd.) Schultes.

Abundant in low grounds. In full flower June 7; completely dried up in August.

* ELEOCHARIS ROSTELLATA Torr.

Abundant in salt marshes on Swain's Neck and adjoining shores of Bache's Harbor; also brackish marshes at Eatfire. Heads dried in August.

SCIRPUS NANUS Spreng.

Abundant in brackish mud about ponds on the south shore; shores of Hummock Pond. Spikes just appearing June 17.

SCIRPUS AMERICANUS Pers.

Very common on shores and in wet places generally. Just in flower June 7.

SCIRPUS VALIDUS Vahl.

Infrequent; Shawkemo, along a brackish creek; pool in Polpis; in a water-hole back of the shore at Capaum Pond; Miacomet Pond. Spikes just appearing June 7; fully mature August 16, 1906. Spikes ovoid to ovoid-oblong, 5–6 mm. long; achene about 1.5 mm. long, 1–1.25 mm. wide.

* SCIRPUS OCCIDENTALIS (S. Wats.) Chase.

Common in Hummock Pond in water off the shore. Agrees closely with Mrs. Chase's description (Rhodora, **6**: 68–70. 1904) and matches well with the common plant of the St. Lawrence River about Alexandria Bay. The Nantucket plant is the form with dark brown spikes, not over 10 mm. long, borne in capitate clusters. Scales much longer and larger than in *S. validus;* achene 2–2.25 mm. long, 1.50–1.75 mm. wide. Spikelets just appearing June 7; fully mature August 15, 1906.

SCIRPUS PALUDOSUS A. Nelson.

Common in saline soil, especially about the south shore ponds. Spikelets beginning to appear June 7.

* SCIRPUS ROBUSTUS Pursh.

A luxuriant growth of this rush completely filled a wet depression among lumber piles near the old wharves, Aug. 15, 1906, occupying perhaps half a square rod; the plants were fruiting abundantly and were of unusual size, some being seven feet tall. In September, 1907, the colony had been much disturbed by a rearrangement of the lumber and in June, 1908, only a few plants remained, none being yet in flower. Nothing was seen of this species elsewhere on the island and its situation near the wharves suggests that it may have been introduced.

* SCIRPUS RUBROTINCTUS Fernald.

Frequent in the town region. In great abundance in a low field near the "Creeks," where it was first observed Aug. 15, 1906, apparently a second growth after mowing, since the field was green from the tufts of basal leaves, yet no stems could be found; damp lot south side of the town; borders of Lily Pond; at several places in damp fields west of the town and about Millbrook Swamp. Generally in full flower by June 15.

SCIRPUS CYPERINUS (L.) Kunth.

Common. Subject to much variation in the form of the inflorescence and in the time of flowering. A late-flowering form is tall and stout with stiff, much elongated inflorescence, often more foliaceous-bracted than in the earlier-flowering form and sometimes wholly green and immature in September when the latter growing with it is fully ripe; the base of the involucels is variable in color but is often a dull black.

Forms answering the description of var. *pelius* Fernald are frequent, intergrading variously with the more common form. The state of the plant with congested inflorescence (var. *condensatus* Fernald) was observed several times in its extreme phase; certain specimens appeared to represent a congested state of the var. *pelius* rather than of the typical form, which is also subject to the same variation.

* SCIRPUS PEDICELLATUS Fernald.

Infrequent. Typical examples were collected, as well as other specimens which are so close to *S. cyperinus* as to be only arbitrarily separable.

* ERIOPHORUM VIRIDE-CARINATUM (Engelm.) Fernald.

Watt's Run Bog, June 15, a scattered group of strongly developed plants conspicuous from the bright wool of the mature and falling spikelets. The wool is of silky character and tinged with palest buff. Near by, *Eriophorum tenellum* showed its inflorescence only just beginning to appear.

ERIOPHORUM TENELLUM Nutt.

Rather common. Long Pond; Maxcy's Pond; Waqutuquaib Pond; Pout Ponds and ponds to the eastward in Shawkemo Hills; several sphagnum bogs west of Sachacha; Watt's Run; ponds in Polpis. In favorable places conspicuous from its white wool by June 18; few spikelets remain after the middle of August.

*Eriophorum gracile* Koch is admitted in Mrs. Owen's catalogue, but as this species was formerly often confused with *E. tenellum* the record should now be substantiated.

ERIOPHORUM VIRGINICUM L.

Common in wet bogs generally and locally abundant.

The form with the heads white or nearly so, presumably var. *album* Gray, is occasionally met with, but, although the wool may

appear pure white I have invariably found that some slight brownish tinge was revealed to close inspection.

RYNCHOSPORA GLOMERATA (L.) Vahl.

Very common in low grounds.

RYNCHOSPORA ALBA (L.) Vahl.

Frequent or common in sandy swamps and cold bogs, often growing in wet sphagnum.

* RYNCHOSPORA TORREYANA A. Gray.

First found on Nantucket, August 30, 1904, between 'Sconset and Tom Never's Pond, scattered here and there along a damp, sandy, nearly obliterated cart-path through an open growth of low vegetation, its flower-clusters in all stages of development up to full maturity. On September 15, 1897, it was found in considerable abundance over a damp sandy level south of the 'Sconset road near the seventh mile-stone, about a mile from where it had been found three years before. Here it was associated with *Drosera filiformis*, *Blephariglottis Blephariglottis*, *Lycopodium alopecuroides*, and other interesting plants.

CLADIUM MARISCOIDES (Muhl.) Torr.

By many pond shores and in wet places except apparently along the south side of the island. Cranberry bog on the shore of Maxcy's Pond; Waqutuquaib Pond; completely filling a considerable boggy place among the dunes near North Pond; ponds in Polpis; Almanac Pond; abundant at southwest side of Sachacha Pond; borders of salt marshes at Eatfire and on Swain's Neck.

SCLERIA TRIGLOMERATA Michx.

A small scattered colony on a dry exposed hillside between Saul's Hills and Sachacha, Sept. 19, 1907; achenes unusually large, 3 mm. long, 2.5 mm. thick; leaves rather stiff, 2–4 mm. wide.

Included in Mrs. Owen's catalogue on the authority of Professor Edward S. Burgess. Professor Burgess writes me that he recalls having found the plant about 1882 on the south side of the island near the Weeweeder Ponds, this locality being over six miles from the second station here reported.

* CAREX INTUMESCENS Rudge.

Local on the western side of the island; at several places along the north side of Trot's Swamp; west of Trot's Swamp; the

"Woods"; Millbrook Swamp. Spikes very immature June 10; heads still green September 14, 1907.

CAREX LUPULINA Muhl.

Not common, but scattered here and there throughout the width of the island: ditch west of the town; near Long Pond; pool on the "Plains"; abundant at a small pond by the road west of Quaise; bog-holes south of Wauwinet. Spikes beginning to show June 9; still fresh after the middle of September.

* CAREX LUPULINA PEDUNCULATA Dewey.

A luxuriant growth about a pond hole almost hidden by dense thickets less than half a mile to the southeast of Bedlow's Pond; spikes fresh Sept. 19, 1907.

Appearing very distinct from typical *C. lupulina*, which seems to be very constant in its characters at the various localities where it occurs on Nantucket.

CAREX LURIDA Wahl.

Common in low grounds; examples approaching var. *flaccida* Bailey occasionally met with. Spikes very immature June 10; still fresh Sept. 15, 1907.

* CAREX UTRICULATA Boott.

Northern end of Millbrook Swamp, filling an inundated place of perhaps half an acre to the exclusion of all other vegetation. Fully mature and fruiting abundantly June 9. A tall, stout form of the plant, larger examples having leaves 5–10 cm. wide and spikes 4–10 cm. long by 1–1.5 cm. thick. Where the water had dried away at the edge of the bog many plants were much reduced in size, corresponding to Boott's var. *minor*; in these smaller specimens the leaves were only 2–6 mm. wide and the spikes 2–3 cm. long.

* CAREX BULLATA Schkuhr.

Very local, but growing in profusion at the few places where it is found. The narrow-spiked typical form occurs in a low meadow west of the town, mostly in the shade of bordering shrubbery and taller vegetation, where it was abundantly in flower but still immature on June 9. The broad-spiked form [*C. physaema* Dewey, *C. bullata* var. *Greenii* (Boeckl.) Fernald] occurs in abundance in open, very wet sphagnum bogs in Quaise, and was

rather more mature than the narrow-spiked form at the same date. In a very wet place southwest of Sachacha Pond is a large patch of a form somewhat intermediate between its two extremes but apparently best referred to a small-spiked state of the broader-spiked form. Here the spikes were still green as late as September 19, 1904.

In their extreme states the broad-spiked and narrow-spiked forms of this plant present rather striking differences and appear quite distinct, but these differences are subject to a most confusing interchange in whole or in part, so that it is sometimes difficult to assign specimens to either form. My own observations on Long Island make it appear probable that the narrow-spiked form is a state which sometimes reflects conditions of greater shade, and again expresses a modified development through a drying up of the soil before the plant has reached its natural maturity. Contributory to this view is the fact that the narrow-spiked form seems to be quite generally infertile.

CAREX COMOSA Boott.

Rather common in wet places. Spikes just appearing June 15; still fresh at the middle of September. At Watt's Run with unusually narrow spikes simulating *C. pseudo-cyperus*.

* CAREX VESTITA Willd.

At a number of rather widely separated localities: Trot's Swamp; Millbrook Swamp; Quaise; Polpis; Tom Never's Pond and at several places about the borders of the swamp. In full flower June 10; no perigynia remaining August 7, 1906. Often occurs in wetter places than is usual for this species, sometimes even growing in wet sphagnum.

* CAREX WALTERIANA Bailey.

Occurs rather sparingly in a small bog south of the roadside fountain erected by the Commonwealth of Massachusetts to mark the birthplace of Abiah Folger Franklin, mother of Benjamin Franklin. In perfect fruiting condition June 10, 1908; perigynia wholly glabrous.

* CAREX LANUGINOSA Michx.

Meadow near Reed Pond, a slender form suggesting *C. filiformis* L. A very stout distinct-appearing form was collected in

a sphagnum bog in Quaise, June 11; the stiff nodulose leaves were unusually broad, even as wide as 6 mm.; the densely flowered spikes were 5–7 mm. thick, with perigynia 4.5 mm. long and 2.75 mm. thick, less spreading than in the ordinary form and with more deeply colored, appressed-ascending rather than spreading scales.

*Carex filiformis* L. of Mrs. Owen's catalogue may have referred to the slender form of *C. lanuginosa* mentioned above; at least, the record of *C. filiformis* should now be confirmed.

* CAREX HIRTA L.

Sparingly in a low field between the Point Breeze Hotel and the shore. Not fully mature June 7.

* CAREX STRICTA Lam.

Found only near Reed Pond, a fairly typical form, although only moderately tufted and not forming the strong, dense tussocks which are so characteristic of this sedge under favorable conditions. In full flower June 8.

Lower leaf-sheaths becoming strongly cross-fibrillose; leaves and culms much greener and rougher-margined than in *Carex Goodenovii*, the leaves longer and narrower; spikes more remote and narrower with more numerous, smaller, more acute, nerveless or obscurely few-nerved perigynia and narrower, more attenuate and much less deeply colored scales.

The plant grew in close association with *Carex Goodenovii* and the two species seemed to intergrade so perfectly that certain specimens appeared precisely intermediate and impossible of definite assignment to either.

Ill-defined and intergrading hybrids between very closely allied species scarcely seem to justify formal designation. Unproved, indeed, as most alleged hybrids are, their occurrence seems to be wholly dependent on chance conditions of unusual propinquity in the supposed parent species. Such intermediate plants seem to fall into a different category from that of well-defined intermediates of wholly detached existence as, for instance, some of the alleged hybrids in *Viola* which, if they be of hybrid origin, are perhaps none the less species because plants whose origin has not remained wholly concealed.

Nothing was seen of *Carex aquatilis* Wahl., which is named by Mrs. Owen. In the wide variation shown by *Carex Goodenovii* are taller, more leafy-bracted forms somewhat simulating forms of *C. aquatilis*, the record of which, on Nantucket, it seems proper, therefore, to place in abeyance until positive evidence of its occurrence is forthcoming.

CAREX GOODENOVII J. Gay.

One of the characteristic sedges of the island, growing everywhere in low grounds and wet places, often in such abundance as to tinge fields and meadows for rods together with the bluish green hue of its leaves or the dark color of its mature spikes. In full flower June 7; some green spikes are to be found as late as the middle of August and dried spikes over a month later.

In many of its characters this sedge exhibits unusually wide variations, but, great as these differences are, all appear to be variously interchangeable among the numerous forms which the species assumes and I have not been able to discover that any set of characters is ever associated so securely as to indicate any very strong subspecific tendency.

The form defined by Bailey as var. *strictiformis* (*Carex vulgaris* Fries, var. *strictiformis*, Mem. Torrey Club **1**: 74. 1889) and attributed to Nantucket is readily enough recognized in its extreme state, but it is itself so variable and so confusingly involved with other forms that, as Professor Fernald has already concluded, there is no sound basis for its recognition (Rhodora **4**: 224. 1902).

On Nantucket this *Carex* varies from 1 to 8 dm. in height, the leaves from longer than the culm to less than half its length and from 0.5 to 3.5 mm. in width, and in color from glaucous blue to nearly green; the spikes may be short-cylindric, stiff, and sessile, with closely crowded spreading perigynia, or narrowly linear, short-stalked and somewhat spreading and very loosely flowered; the perigynia vary from nearly orbicular and broadly rounded above to elliptic and obtuse or even to narrowly oblong and acute, and from faintly few-nerved to distinctly 7–11-nerved; the color at maturity varies from bright pale green or dull green to black-purple; the extremes of size and shape of the perigynia may be expressed by the measurements 3 × 3 mm. and 2–3.5 × 1.5 mm.; the scales, while always very dark in color and usually rounded-

obtuse and much shorter than the perigynia, are sometimes more elongated and acute or the lower ones even aristate; the staminate spikes may be 1 to 3, sessile or slender-stalked, and are very variable in size, shape, and color; frequently the fertile spikes are staminate at the apex and sometimes even at the base.

* CAREX GYNANDRA Schwein.

Uncommon, in sphagnum bogs, usually in the protection of bordering shrubbery: at several places in Watt's Run bog; Quaise, near Bache's Harbor; southwest side of Sachacha Pond. Freshly in flower June 10; perigynia brown and mostly fallen Sept. 17, 1897. Lower sheaths minutely pubescent.

* CAREX VIRESCENS Muhl.

*C. virescens* var. *minima* Barratt; Bailey, Mem. Torrey Club 1: 77. 1889.

*C. virescens* var. *Swanii* Fernald, Rhodora 8: 183. 1906. Rather common in grassy open grounds and thickets. Just in flower June 7; some spikes still green in early September, 1904.

I am unable to adopt Professor Fernald's view (*loc. cit.*) that the true *C. virescens* of Muhlenberg, published by Willdenow and by Schkuhr, is not our common short-spiked plant which has for so long a time borne the name, but the woodland plant with longer spikes, by Schweinitz described as *C. costata*, by Dewey as var. *costata*, and later by Doctor Britton, most certainly with ample reason, restored to full specific rank as *C. costellata*.

Both Willdenow's description and Schkuhr's figure, upon which Professor Fernald has based his readjustment of the nomenclature of these plants, afford to my mind convincing evidence that the long accepted application of the name *C. virescens* should have remained undisturbed.

Schkuhr's illustration presents one very young entire plant and the fruiting top of a plant nearly mature. The former is accurately shown with the spikes much more slender than they become when fully developed. The latter, although not representing the extreme of our shorter-spiked plant, corresponds precisely with frequent examples, even responding accurately to exact measurements of the spikes and their relative positions. The illustrations of the detached perigynia are even more unmistakable.

They are shown as broadly ovoid or obovoid without visible nerves and are not to be reconciled with the elliptic, conspicuously costate perigynia of *C. costellata*. Finally Bailey has put on record that he has examined the type of *C. virescens* in Willdenow's herbarium and in regard to it he has repeated in several places that it is our smaller shorter-spiked plant (Mem. Torrey Club **1**: 61, 76, 78. 1889.)

* CAREX TENUIS Rudge.

Locally common but occuring only in a few localites: at several places in the "Woods" and along the borders of Trot's Swamp; copse on bank at Watt's Run. In perfect fruiting condition June 10; few perigynia remaining September 15, 1906.

CAREX PALLESCENS L.

Frequent or almost common, but somewhat local, although rather widely distributed over the island except apparently along the south side. Spikes of full size June 7.

CAREX PENNSYLVANICA Lam.

Abundant, sharing with *C. Goodenovii* and *C. cephalantha* the distinction of being one of the three most abundant *Carices* on the island. Fully mature June 7; readily recognizable from the leaves in the late summer and autumn.

The common woodland form with soft and very narrow elongated leaves is abundant over the moorland and in dry thickets. On the exposed plains the plant is lower and much stiffer-leaved and separates further into two forms which in their extreme phases are set off markedly from each other on close comparison. In one the pale leaves become stiff and coarse and over 3 mm. wide, and the stiff culms mostly 5–15 cm. high; in the other the leaves are narrower and rougher and the culms rather longer, although shorter than the leaves; in this also the perigynia are mostly larger than in the companion form and less abruptly rounded to a slightly longer sharper-toothed beak, the scales are also longer and sharper and commonly more spreading and more deeply colored.

* CAREX EMMONSII Dewey; Torr. Ann. Lyc. N. Y. **3**: 411. 1836.
*C. alpestris* Dewey, Sill. Jour. I. **7**: 268. 1824. *Fide* Torr.
*C. alpestris* Schwein. & Torr. Ann. Lyc. N. Y. **1**: 341. 1825. Not Allioni, *fide* Torr.

*C. Davisii* Dewey, Car. 279. 1826. Not Schwein. & Torr.
*C. varia*, in part, of recent authors, not Muhl.

Common in dryish spots near damp or swampy ground, often in sandy soil, and in partial shade about the borders of low thickets. Fully mature June 9; in the summer and autumn, its low, close tufts of soft leaves make it easily recognizable, there being no species on the island with which it might be confused.

The name *Carex Emmonsii*, here restored to a place in our flora, has not been in use for many years. The plant so named by Dewey was denoted so explicitly in Torrey's "Monograph" that it is hard to understand how it could have remained for so long a period confused with the *Carex varia* of Muhlenberg. In 1889 (Mem. Torrey Club 1: 40, 41) Bailey showed that our common woodland *Carex* (*C. communis* Bailey), which had up to that time been known as *Carex varia* Muhl., was not the sedge to which this name rightly belonged. But in correcting one error another was committed, and his mistaken relegation of the name *Carex Emmonsii* to synonymy under *C. varia* Muhl. seems never to have been called in question. Nevertheless, I do not think it will be disputed by any one knowing the two plants that, although closely allied, they are yet perfectly distinct.

*Carex Emmonsii* often so closely resembles forms of *Carex albicans* Willd. and *Carex deflexa* Hornem. that it may be easily mistaken for them. Its relationship to these species is indeed close but, disregarding other characters, it may be readily distinguished from them by its narrower and longer-beaked perigynia.

*Carex varia* Muhl. is a plant of dry, open, hilly or rocky woodland. Its culms are mostly erect, noticeably surpassing the numerous very narrow leaves; the staminate spike is distinct, or even conspicuous, and commonly about 10 mm. in length, the mostly purplish pistillate spikes distinct or separated by definite intervals.

*Carex Emmonsii* differs in more slender, commonly prostrate culms, much surpassed by the tufts of elongated flexuous leaves, some of which become 2.5 mm. in width; staminate spike very small or inconspicuous, 2–6 mm. long, often partly pistillate at summit; fertile spikes contiguous in a short, close head, mostly

pale green; perigynia commonly narrower, greener and less pubescent, more attenuate at base and apex, the beak longer; scales of both fertile and staminate spikes longer and narrower, more attenuate and sharper and usually much paler in color or wholly white.

*Carex Emmonsii* is more of a shade plant than *Carex varia* and is most at home about the dryish borders of wet thickets or boggy places in the woods either on hills or in low grounds. On Long Island it is common on the coastal plain as well as on the hills; *Carex varia* occurs in drier, more open places on the hills but seems to be wholly absent from the coastal plain.

When these two plants are once understood I think there is little likelihood of their being mistaken for each other.

* CAREX UMBELLATA Schkuhr.

Common in sandy open ground; fully mature June 7 to 17. Perigynia 3.5–4 mm. long, 1.5–2 mm. wide, slightly pubescent to glabrate, more or less nerved, at maturity becoming distended, pulpy, and white at the base, the beak 1–1.5 mm. long; achene ovoid-subglobose, obscurely 3-sided, 1.5–1.75 mm. long, 1.25–1.50 mm. thick, dull grayish black or silvery, appearing minutely roughened.

This plant agrees so well with Schkuhr's illustration of *Carex umbellata* that there can be little doubt that it is definitely typical, although a form with longer-beaked, more pubescent perigynia would seem to have been commonly understood in that sense. The plant here in view, notwithstanding its comparatively short beak, is not the var. *brevirostris* Boott. The latter plant or one which must be referred to it on the basis of descriptions, is frequent on Long Island, N. Y., where the typical plant seems to be rare, the prevailing form being the var. *tonsa* Fernald. The var. *brevirostris* often occurs with the latter and differs from it constantly in definite characters. It commonly forms larger, closer tufts and has much longer, narrower, more erect and less rigid leaves and more slender culms, some of which are capillary and elongated and bear a slender-pedicelled, bracteate fertile spike near the base of the staminate one; the perigynia are mostly pubescent and only 2.5–3 mm. long, with the short beak only 0.5–1 mm., the achene pale brown, rather shining and about 1.5 mm. long by 1 mm. thick. I have long regarded this plant as a distinct species and

have deposited specimens from Richmond Hill, Long Island, in the herbarium of the N. Y. Botanical Garden labeled **Carex abdita.**

* **Carex tonsa** (Fernald) comb. nov.

*Carex umbellata* var. *tonsa* Fernald, Proc. Amer. Acad. **37**: 507. 1902.

Common in the same situations as *Carex umbellata*; in exposed places with the perigynia nearly gone June 9; in the shade of pines still with full-flowered spikes June 17. Perigynia mostly about 4 mm. long by 1–1.5 mm. thick, nerved or nerveless, the slender often curved beak 2 mm. long; achene 1–1.25 mm. long by 0.75–1 mm. thick, trigonous-obovoid, chestnut-brown, often shining as if polished, contrasting even more markedly with that of *C. umbellata*, as described above, than with that of *C. abdita*.

In the autumn the plant may be readily recognized from its small tufts of stiff partly spreading leaves.

* CAREX LEPTALEA Wahl.

Along a mossy run through a sphagnum bog in Quaise, also Watt's Run Bog; fully developed June 1.

CAREX STIPATA Muhl.

Common in bogs and low grounds, often along brooks and ditches. In full flower June 7; a few perigynia accidentally persistent into September.

Remarkably large plants were found in a muddy thicket around a pot-hole near Tristram Coffin's Homestead in September, 1907; some of the bright green tufts were 12 dm. tall, with leaves 12 mm. wide, strongly 3-plicate and very roughly margined.

CAREX VULPINOIDEA Michx.

Frequent in low grounds. Spikes only beginning to appear June 9; perigynia falling or sometimes quite gone in September.

* **Carex annectens** comb. nov.

*Carex xanthocarpa annectens* Bicknell, Bull. Torrey Club **23**: 23. 1896.

Uncommon or rare. 'Sconset, June 13, in damp spot at edge of field by a farmyard, immature — a somewhat reduced form, bractlets and awns of the scales conspicuous; ditch near the south shore between Hummock and Miacomet ponds, June 17, imma-

ture — a taller and stouter form, less conspicuously awned and bracteate.

*Carex rosea* Schkuhr is admitted by Mrs. Owen. This record seems to need confirmation, especially as the species is sometimes rather strikingly suggested by slender, few-flowered forms of *Carex cephalantha* Bailey.

* CAREX MURICATA L.

Thoroughly naturalized in the town region, often growing in dense tufts and in some places fairly massed along the fences bordering low fields and roadsides.

On Sept. 15, 1907, some of these luxuriant growths had become a tangle of widely overcurved and reclined culms, many of them 4 feet to 4 feet 10 inches in length and bearing dark brown heads of mature fruit. At the same time some thin tufts in a dry pasture west of the town bore short, nearly prostrate culms only 3–4 dm. long. Freshly in flower June 7. Not seen further from the town than about one mile out on the south side.

CAREX MUHLENBERGII Schkuhr.

Occasional or frequent in dry open places. Freshly in flower June 7; mostly beyond full maturity in September. Fully typical specimens were collected, as well as a smaller, more slender form in which the heads are 1.25–2.5 cm. long and the perigynia 3 mm. or less long and 1.5–2 mm. wide.

**Carex cephalantha** (Bailey) comb. nov.

*C. echinata* Murray var. *cephalantha* Bailey, Mem. Torrey Club 1: 58. 1889.

*C. stellulata* var. *cephalantha* Fernald, Rhodora 4: 222. 1902.

*C. stellulata* var. *excelsior* (Bailey) Fernald, *loc. cit.*

One of the abundant *Carices* of the island, occurring everywhere in open, low grounds and wet places. A considerable range of variation is shown, which appears to be largely a matter of relative vigor of growth. In its most reduced state the plant is 2–3 dm. high, the leaves 1 mm. or less in width, the 3–5 few-flowered subglobose spikes approximate in a head sometimes only 2 cm. long. From these smaller plants the gradation is insensible to the larger forms over 5 dm. tall, with heads 4–6 cm. long, of 5 or 6 many-flowered spikes, the lower ones well separated and

becoming cylindric and 10 mm. long. There seems to be no essential difference between the perigynia of the larger and smaller plants, although the latter sometimes show some approach to the narrower perigynia of var. *angustata*, but this form in its typical state was not met with. At a locality in Quaise the ordinary form of the plant was found passing into a state with flexuous or even nodding heads of scattered spikelets 1–2 cm. apart.

* **Carex incomperta** sp. nov.

Densely tufted, 4–6 dm. high, leaves numerous, bright green and rather soft, flexuous, much surpassing the culms, 1–2 cm. wide; culms slender, roughened towards the top; spikelets 3 or 4, contiguous or slightly separated in a head 1.5–2 cm. long, small, subglobose, mostly 5–6 mm. long and wide, 9–17-flowered, the terminal one often clavate at base; perigynia thin, flattened, deltoid-ovate, often subcordate, more or less striate-nerved on both faces, abruptly contracted into a prominent, narrow, slightly rough-edged beak one third to one half its length, finally wide-spreading; scales ovate, thin, pale, becoming slightly brownish, obtuse or acute, about two thirds the length of the perigynia.

Type from Nantucket, June 20, 1908, wet bog below the Sea Cliff Inn, deposited in herb. N. Y. Botanical Garden.

This *Carex* lies midway between *C. sterilis* Willd. and *C. cephalantha* (Bailey) and did it occur with them the evidence for hybridity would be not less convincing than that on which many a published hybrid is based. *C. sterilis*, however, does not belong to the Nantucket flora as far as known, and, should it possibly occur on the island, must be extremely rare and local.

*Carex incomperta* seems to be not common in herbaria but I have seen specimens, variously referred to *C. sterilis* and to *C. cephalantha*, which give it a range from Massachusetts to Michigan, New Jersey, and Georgia. Its broadly deltoid perigynia would, by the books, place it definitely with *C. sterilis*, yet after careful study I am unable to include it with that species, nor can I force it into *C. cephalantha* under any view of that species not too carelessly broad.

Compared with smaller forms of *C. sterilis*, the aspect of the head is so similar as sometimes to appear identical except to very close inspection, yet I cannot regard the two plants as in any way interrelated. *C. sterilis* differs materially in coarser habit, much

broader and shorter paler green leaves of obviously different cellular structure under a lens, larger and more numerously flowered spikelets, and shorter, broader, and more obtuse scales of firmer texture, differences which are especially obvious in the scales investing the clavate base of the terminal spike; the perigynia of *C. sterilis*, although not always broader, are of thicker texture, more strongly nerved and thick-margined, paler in color and less abruptly narrowed to a shorter, broader, more graduated, and rougher-edged beak.

As compared with *C. cephalantha*, the leaves are longer, softer, and of thinner texture, the spikes fewer, the scales paler, shorter, and much less attenuate and acute; the perigynia, in addition to the deltoid base, are much thinner, more coarsely nerved and much more abruptly narrowed to a narrower, shorter, and less rough-edged beak.

The plant might be compared to an overgrown *Carex interior capillacea* Bailey, from which, however, it is at once distinguished by the prominently narrow-beaked perigynium.

Although reluctant to add another species to this difficult group of sedges, I do not know how else to report this plant as a member of the Nantucket flora. There it grew in abundance, forming large tufts in a very wet bog below the cliff where it was collected on June 21.

**Carex delicatula** nom. nov.

*C. interior capillacea* Bailey, Bull. Torrey Club **20**: 426. 1893.

*C. scirpoides capillacea* Fernald, Rhodora **10**: 47, 48. 1908.

Bogs and wet thickets, common. Forming close tufts of very numerous, capillary, flexuous culms, 2–7 dm. long, the elongated leaves mostly less than 0.5 mm. wide. In full flower June 7; persisting spikelets are sometimes to be found as late as the third week in September.

* CAREX SEORSA E. C. Howe.

Sparingly in damp thicket at the west side of Trot's Swamp; in abundance in a wet thicket in Polpis; mature on June 10.

**Carex disjuncta** (Fernald) comb. nov.

*C. canescens* var. *disjuncta* Fernald, Proc. Amer. Acad. **37**: 488. 1902.

Common in swamps and very wet bogs; fully developed June 7; a few dried spikelets remaining Sept. 8, 1904.

**Carex subloliacea** (Laest.) comb. nov.

*C. canescens* var. *subloliacea* Laest. Nov. Act. Soc. Sci. Ups. II: 282.

Common in wet sphagnum bogs, sometimes growing with *Carex canescens* and perhaps intergrading or hybridizing with it, but in its perfectly developed condition a very distinct plant. Fully mature June 7; a few persisting perigynia Sept. 19, 1907.

*Carex canescens* var. *alpicola* Wahl. of Mrs. Owen's list (*C. brunnescens* Poir.) doubtless refers to the present plant.

CAREX SCOPARIA Schkuhr.

Common in low grounds. The state with more or less moniliform spike (var. *moniliformis* Tuckerm.) is frequent, as is also a reduced form corresponding to the var. *invisa* of *Carex hormathodes* Fernald. Very immature June 7, spikes mostly dried in September.

* CAREX STRAMINEA Willd.

Met with only at one locality, on the north side of Trot's Swamp, where it grew very sparingly on dry ground among scattered shrubbery; scarcely mature June 10.

Very slender, 4–5 dm. tall, the leaves 0.5–2 mm. wide; spikelets 2–5, small, on a weak or flexuous axis 2–3 cm. long, ovoid, abruptly contracted to a short, staminate base, rather closely ascending; perigynia mostly 3.5 mm. long by 1.75 mm. wide, more or less nerved on both faces, gradually narrowed into a rather broad and rough-edged beak; scales rather deep brown, the lower very obtuse, those above becoming more attenuate and acute.

* CAREX STRAMINEA ECHINODES Fernald, Proc. Amer. Acad. **37**: 474. 1902.

Sparingly in damp ground at one place in the "Woods"; nearly mature June 17.

Slender, 4–6 dm. tall, the leaves 1–2.5 mm. wide; spikelets 5–7 in a more or less moniliform, straight or flexuous spike 2.5–5 cm. long, small, ovoid-subglobose, narrowed into a conspicuously chaffy, clavate base; perigynia early spreading, mostly 3 mm. long by 2 mm. wide, nerveless or nearly so on both faces, the body

nearly orbicular, abruptly narrowed or rounded to the narrow and conspicuous somewhat rough-edged beak; scales very thin, even the lowest acute, pale stamineous; achene definitely larger and plumper than that of the preceding, and elliptic-oblong instead of ovate.

The two sedges here compared appear to me to be distinct, especially by comparison of the perigynia and achenes, and if Professor Fernald's var. *echinodes* is properly represented by the plant here referred to it, I should feel that there was little reason to doubt that it should stand as a species.

CAREX SILICEA Olney.

Common in sand, mostly along and near the beaches, but sometimes on the higher parts of the island quite away from immediate saline influence — spikes well developed June 7; mostly dried by September.

CAREX HORMATHODES Fernald, Rhodora 8: 165. 1906.

Very common in low, open grounds, and apparently less restricted to the neighborhood of salt marshes than in many localities along the coast. Spikes well developed June 7; spikelets mostly dried or gone by September. Probably the *C. straminea* of Mrs. Owen's list.

The so-called var. *invisa* (Boott) seems to be nothing more than a reduced and often late-flowering state of the plant to which there is no greater reason for according varietal status than for deducing varieties from parallel reduced states of almost all of its near relatives in the *Ovales*.

Where this species grows in abundance with *C. albolutescens*, occasional plants are so nearly intermediate that, except for the absence of actual proof, they might well be pronounced hybrids. Likewise, specimens were found which appeared quite intermediate with *C. scoparia*.

CAREX ALBOLUTESCENS Schwein.

Common near the beaches and salt marshes but also in wet places generally. In fresh-water swamps and about the borders of ponds a form occurs with greener, softer leaves and culms, and often longer heads of less approximate spikes, which are longer and more acute, with longer and narrower perigynia, narrower achene and more stramineous scales; in this form the spikes be-

come 7–10 mm. long and the perigynia 4–4.5 mm. A reduced fresh-water form has heads sometimes not over 5 mm. long and perigynia only 2–2.5 mm. in length.

This is doubtless the *C. adusta* of Mrs. Owen's catalogue and probably also the *C. straminea* var. *alata*.

# Studies in the genus Gymnosporangium*

FRANK D. KERN

The first systematic study of the genus *Gymnosporangium* as it occurs in America was published by Farlow in 1880 in a paper entitled "The Gymnosporangia or Cedar-Apples of the United States."† European investigators had demonstrated several years earlier ‡ the genetic connection between members of the genera *Gymnosporangium* and *Roestelia*, and it was the desire to study the development of the American species in a similar manner which led to this attempt to define the species morphologically. Such a course was especially necessary because of the variety of forms inhabitating the same host, and the consequent small amount of aid which the host furnished in defining the limits of the various forms or species as they were believed to be. For instance, the earlier artificial cultures in America showed that infection on *Amelanchier* leaves was obtained from the sowing of spores of six apparently distinct species of *Gymnosporangium*, four of which occurred on the red cedar, *Sabina virginiana*. The necessity of following up these cultures and determining whether uniform and recognizable differences were evident in the resulting roestelial forms became at once apparent.

For eleven years, or until 1891, work on this group, by means of anatomical studies supplemented with cultures, was kept up by Farlow and Thaxter. During this period six species of *Gymnosporangium* were successfully connected to their roestelial phase, only one being a repetition of European investigations. The more important results are contained in the following papers: "Notes on some Species of *Gymnosporangium* and *Chrysomyxa* in the United States," by W. G. Farlow; § "The Development

* Read before Section G of the American Association for the Advancement of Science, at the Chicago meeting, January 2, 1908.

† Anniv. Mem. Boston Soc. Nat. Hist. 1880.

‡ Bot. Zeit. **23**: 291. 1865; **25**: 222. 1867. Overs. Danske Vid. Selsk. Forh. **1866**: 185–196. *pl. 3, 4.* 1866. Bull. Soc. Roy. Dan. Sci. **1866**: 15, 16. 1866.

§ Proc. Amer. Acad. **20**: 311–328. 1885.

of the *Gymnosporangia* of the United States," by W. G. Farlow *; "On certain Cultures of *Gymnosporangium*, with Notes on their *Roesteliae*," by Roland Thaxter †; "Notes on Cultures of *Gymnosporangium* made in 1887 and 1888," by Roland Thaxter ‡; and "The Connecticut Species of *Gymnosporangium* (Cedar Apples)," by Roland Thaxter. § Besides these there have appeared numerous other notes dealing chiefly with the economic importance and genetic connection of certain species, the results serving to confirm the facts given in the papers mentioned.

In addition to ascertaining how many valid species existed in this country, the earlier workers met with the difficulty of deciding how many of these they recognized were like those already described in Europe. With a comparatively small number of specimens and those from a limited area in the New England and other eastern states, together with incomplete culture data, it is not a matter of surprise that some wrong references should be made which might later be explained and adjusted, but which, in some instances, have not been so treated up to the present time.

The foregoing is a brief statement of the problems encountered by those who began the systematic study of the genus *Gymnosporangium* in this country, with an abstract summary of the published results. Since the date of the last paper mentioned, 1891, there has been some increase of information concerning the group, and a gradual accumulation of specimens in herbaria, but there is practically no more available fundamental knowledge, in so far as published accounts are concerned.

In taking up the study of the group recently, much difficulty was experienced, therefore, and making headway was slow at first, partly due to the chaotic condition of the data left by the past workers, but due also to the fact that it was insufficient when put into usable form. These difficulties have been met and are being largely overcome, for the present, by the selection of new diagnostic characters, not heretofore employed, and by the detailed study and comparison of a large number of specimens from practically the whole geographical area of the United States and repre-

* Bot. Gaz. 11 : 234–241. 1886.

† Proc. Amer. Acad. 22 : 259–269. 1887.

‡ Bot. Gaz. 14 : 163–172. 1889.

§ Bull. Conn. Agric. Exper. Station 107. 1891.

senting nearly all possible ecological conditions. This method of treatment has revealed some undescribed species and the existence of some foreign species not before recognized. In Dr. Dietel's account of the genus *Gymnosporangium* in Engler and Prantl's Natürlichen Pflanzenfamilien in 1897 * he ascribed eight species to North America. This account omitted one which was known at that time and should have been included. Two more were described shortly after this work appeared. In a recent paper the writer has described three new forms of *Gymnosporangium* and three of *Roestelia*, all from the Rocky Mountains or the west coast.† The present paper characterizes three more forms and includes one foreign species recently reported from this country,‡ making in all a total of eighteen species under consideration.

The study of the relationship between the rust species and the host species is now rendered more complicated than it was formerly, owing to the much larger number of rusts recognized on the same number of hosts. In the telial stage, the species of rust, so far as is now known, infest the family *Juniperaceae*, represented by four genera, *Sabina*, *Juniperus*, *Chamaecyparis*, and *Libocedrus*.

On the genus *Sabina* are found twelve species of rust, of which eight inhabit the one host species, *Sabina virginiana*, four of the eight not occurring on any other species of *Sabina*. Four species occur on *Juniperus*, two on *Chamaecyparis*, and one on *Libocedrus*. It is a remarkable fact that each of the *Gymnosporangium* species is confined in the telial stage to a single genus of host plants, with the exception of one, which is reported on both *Sabina* and *Juniperus*, and there is a suspicion that here two species may really exist.

It is a notable fact that in the genus *Gymnosporangium* belong the only rusts which are heteroecious and yet do not possess all spore-forms, the uredinial stage being lacking in all the species. There is known a uredo-form on Juniperaceae from Alaska,§ how-

* E. & P. Nat. Pflanzenfam. $1^{1**}$: 50. 1897.

† New western species of *Gymnosporangium* and *Roestelia*. Bull. Torrey Club **34**: 459–463. 1907.

‡ The existence of *Roestelia penicillata* and its telial phase in North America. Science II. **27**: 931. 1908.

§ Harriman Alaska Expedition **5**: 36. 1904. *Uredo Nootkatensis* Trel. on *Chamaecyparis Nootkatensis*.

ever, which may prove a possible exception to the foregoing statement. There is but one collection of it and so little is known that nothing positive can be stated but it seems probable that it should have a telial stage like *Gymnosporangium*, and be heteroecious with a roestelial stage on some of the *Malaceae*.

*Gymnosporangium* as a genus is characterized in the telial stage by teliospores having hyaline pedicels, usually of great length, which swell in moisture and often become gelatinized to form a jelly-like matrix in which the spores appear to be imbedded. Of interest in connection with the development of this stage are peculiar distortions which are usually produced either in the leaves or branches.

For the purpose of bringing together the data in such a manner as to be of material assistance in the determination of specimens, a key, involving the more evident diagnostic characters of the telia of the known North American species, and indicating the hosts for each one, is presented herewith. Preceding the key, notes are given for some of the species, explanatory of nomenclature, important extensions in range, and other interesting features which have been revealed in these investigations.

GYMNOSPORANGIUM BERMUDIANUM (Farl.) Earle, in Seym. & Earle Econ. Fungi *249*. 1893

This is the most curious of all the species of *Gymnosporangium*, being the only one which is not heteroecious. The aecial stage is a geniune *Roestelia*, developing in the fall on small, irregular, globoid galls, and is followed in the spring by telia on the same galls. The telia are very inconspicuous and may be easily overlooked in the dried condition of herbarium specimens.

GYMNOSPORANGIUM JUNIPERI-VIRGINIANAE Schwein. Schr. Nat. Ges. Leipzig **1**: 74. 1822

The name *Gymnosporagium macropus* Link (Willd. Sp. Pl. **6**: 128) is often used in referring to this species but as it was published in 1825, the one established by Schweinitz in 1822 must be accepted as the valid name.

**Gymnosporangium floriforme** Thaxter, sp. nov.*

Pycnia epiphyllous, numerous, gregarious, on discolored spots, punctiform, honey-yellow becoming blackish, subglobose, 150–175 μ in diameter.

Aecia hypophyllous, rather widely separated in oblong-annular groups 2–6 mm. across, on discolored spots, at first cylindrical, 1–1.5 mm. high, 0.2–0.5 mm. in diameter; peridium soon becoming finely fimbriate and strongly revolute; peridial cells long and narrow, 10–14 μ × 65–85 μ, becoming curved when wet; aeciospores angular-ellipsoid, 18–23 μ × 23–29 μ; wall chestnut-brown, 1.5–2.5 μ thick, finely verrucose; germ pores 6–8, scattered.

On *Crataegus spathulata* Michx., Auburn, Lee County, Alabama, October 21, 1897, *F. S. Earle & C. F. Baker;* October, 1897 *F. S. Earle* (in Sydow, Uredineen no. *1194*); October (year not given) *G. F. Atkinson;* Hot Springs, Arkansas, September 3, 1897, *Wm. Trelease.*

Telia scattered on globose or reniform galls, conical or cylindrical-acuminate, becoming 3–10 mm. long, 1-1.5 mm. wide, chestnut-brown becoming yellowish and pulverulent by germination, surrounded by the ruptured epidermis; teliospores 2-celled, narrowly ellipsoid, 15–19 μ by 39–50 μ, rounded both at apex and base, slightly or not constricted at the septum; wall pale cinnamon-brown, 1–1.5 μ thick, smooth; pedicel hyaline, very long, 3–6 μ in diameter; germ pores 2, near the septum.

On *Sabina virginiana* (L.) Antoine (*Juniperus virginiana* L.), Auburn, Lee Co., Alabama, March 11, 1897, *F. S. Earle* (type);

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*Pycniis epiphyllis, numerosis, in greges dispositis, maculis decoloratis insidentibus, punctiformibus, melleo-flavis, demum atrescentibus, subglobosis, 150–175 μ diam.

Aeciis hypophyllis, in greges oblongo-annulatos 2–6 mm. diam. laxe dispositis, maculis decoloratis insidentibus, primo cylindraceis, 1–1.5 mm. altis, 0.2–0.5 mm. diam.; peridio mox multifido-fimbriato, fimbriis multum revolutis; cellulis peridii longis et angustis, 10–14 μ × 65–85 μ, humidis flectentibus; aeciosporis angulato-ellipsoideis, 18–23 μ × 23–29 μ; episporio castaneo-brunneo, 1.5–2.5 μ crasso, subtiliter verruculoso; poris germinationis 6–8, sine ordine dispersis.

In foliis *Crataegi spathulatae* in Alabama et Arkansas.

Teliis in caespites globosos vel reniformes dispersis, conoideis vel cylindrico-acuminatis, demum 3–10 mm. longis, basi 1–1.5 mm. latis, castaneo-brunneis dein aurantiacis et pulverulentis, epidermide rupta cinctis; teliosporis uniseptatis, angusto-ellipsoideis, 15–19μ × 39–50μ, apice et basi rotundatis, medio non v. vix constrictis; episporio dilute cinnamomeo-brunneo, 1–1.5μ crasso, levibus; pedicello hyalino, longissimo, 3–6μ diam.; poris germinationis binis juxta septum instructis.

In foliis ramulisque *Sabinae virginianae* (*Juniperi virginianae*) Auburn, Lee Co., Alabama, Mar. 11, 1897, *F. S. Earle.*

March 7 and 14, 1896, *Underwood & Earle;* Daytona, Florida, February, 1887, communicated by Dr. Roland Thaxter; Columbus, Mississippi, April 5, 1896, *S. M. Tracy.*

This species is morphologically very similar to *Gymnosporangium Juniperi-virginianae*, but there are some constant differences in the shape of the spore-masses and galls. The spore-masses are darker, shorter, and more conical, while the galls have a peculiar brownish luster. Cultures have been made by Dr. Roland Thaxter at Cambridge, Mass., and by Prof. F. S. Earle at Auburn, Ala., establishing the connection between this and the roestelial form on *Crataegus spathulata.** As a further characteristic, Dr. Thaxter has pointed out in a letter to the writer that it takes this species longer to mature its roestelial form than any other species known to him. The telial stage was fairly well characterized by Underwood and Earle (Bot. Gaz. **27**: 256) in 1896, but no name was employed. In the following year the same authors, in Bull. 80 of the Alabama Experiment Station, p. 218, applied the name *Roestelia flaviformis* without any accompanying description, to the stage on *Crataegus spathulata*, citing Atkinson as an authority. Later, when cultures had proven the connection between the new *Gymnosporangium* on cedar and the *Roestelia* on *Crataegus spathulata*, the combination *Gymnosporangium flaviforme* (Atks.) Earle was made by Earle, *loc. cit.*, without a description. The name *flaviformis* was a misinterpretation of *floriformis*, a herbarium name attached by Thaxter in the Atkinson herbarium.† After consulting with Dr. Thaxter it was decided as preferable to take up the original name *floriforme*. Having furnished notes and specimens and being the author of the name he is cited as the authority.

GYMNOSPORANGIUM CLAVARIAEFORME (Jacq.) DC. Fl. Fr. **2**: 217. 1805

This is the most widely distributed of the three European species found in North America, reaching from the Atlantic states into the heart of the Rocky Mountains. The roestelial stage has

* See Earle, Contr. U. S. Herb. **6**: 186. 1901.

† Farl. Bibl. Index **1**: 44. 1905. "The name *Roestelia flaviformis* given below is a misprint for *Roestelia floriformis*, Thaxter in Herb. Atkinson of which no description has been published. See *Gymnosporangium flaviforme* Earle."

been known from the western mountains for some time and it has been assumed that the telial stage must also exist there.* Several fine collections made by Professor E. Bethel in Colorado have verified the correctness of this assumption.

GYMNOSPORANGIUM ELLISII (Berk.) Farl. in Ellis, N. Am. Fungi, *271*. 1879

The connection between this *Gymnosporangium* and *Roestelia transformans* Ellis has been accepted almost without question for many years and there are reasons for believing it correct, but it may be noted that the culture record is much less authoritative than for most of the other species. Cultures were attempted by Thaxter in 1886 and an examination of his report in the Proc. Am. Acad. **22**: 264 shows that as a result of the sowing of the *Gymnosporangium* on detached leaves of *Pyrus* (*Aronia*) *arbutifolia*, an effect was said to be manifest in about eight days on the *Pyrus* leaves but no roestelial form or even pycnia ever developed. So far as the writer knows, this is the only published account referring to cultures of this species.

GYMNOSPORANGUM SPECIOSUM Peck, Bot. Gaz. **3**: 217. 1879

Although this species has been recognized for a good many years all attempts to connect an aecial form with it have failed. There is in its region no unattached species of *Roestelia* known with which it may be associated and there is not the slightest clue as to what the other stage may be.

GYMNOSPORANGIUM JUNIPERINUM (L.) Mart. Fl. Crypt. Erlang. 333. 1817

Under this name is here included the telial form of *Roestelia penicillata* (Pers.) Fries, which has been usually referred to by European writers as *Gymnosporangium tremelloides* Hartig, since he proposed that name in 1882, and not the telial form of *Roestelia cornuta* (Pers.) Fries. A brief statement of this conclusion has been made by the writer in Science **27**: 931. 1908.

* See Pammel, Bull. Iowa Experiment Station **84**: 32. 1905.

**Gymnosporangium germinale** (Schwein.) comb. nov.

The full synonomy of this species, which shows that the aecial stage was collected and described many years in advance of the telial stage, is here given.

*Caeoma* (*Peridermium*) *germinale* Schwein. Proc. Am. Phil. Soc. **4**: 294. 1832.

*Peridermium* (*Caeoma*) *germinale* Schwein. Proc. Am. Phil. Soc. **4**: 310. 1832.

*Podisoma gymnosporangium clavipes* C. & P. Jour. Quek. Club **2**: 267. 1871.

*Gymnosporangium clavipes* C. & P. Ann. Rep. N. Y. State Mus. **25**: 89. 1873.

*Roestelia aurantiaca* Peck, Ann. Rep. N. Y. State Mus. **25**: 91. 1873.

*Puccinia clavipes* Kuntze, Rev. Gen. Pl. **3**: 507. 1898.

*Tremella clavipes* Arth. Proc. Ind. Acad. Sci. **1900**: 135. 1901.

*Aecidium aurantiacum* Farl. Bibl. Index **1**: 19. Not *A. aurantiacum* Bon. 1860.

*Aecidium germinale* Arth. Result. Sci. Congr. Bot. Vienne 343. 1906.

**Gymnosporangium Botryapites** (Schwein.) comb. nov.

This is another instance in which the aecial name is much older than the telial one and becomes the name of the species. The synonymy is as follows.

*Caeoma* (*Roestelia*) *Botryapites* Schwein. Proc. Am. Phil. Soc. **4**: 294. 1832.

*Ceratites* (*Caeoma*) *Botryapites* Schwein. Proc. Am. Phil. Soc. **4**: 310. 1832.

*Gymnosporangium biseptatum* Ellis, Bull. Torrey Club **5**: 46. 1874.

*Roestelia Ellisii* Peck, Bull. Torrey Club **6**: 13. 1875.

*Roestelia Botryapites* C. & E. Grevillea **5**: 34. 1876.

*Puccinia Botryapites* Kuntze, Rev. Gen. Pl. **3**: 608. 1898.

*Tremella Botryapites* Arth. Proc. Ind. Acad. Sci. **1900**: 135. 1901.

*Aecidium Botryapites* Farl. Bibl. Index **1**: 22. 1905.

**Gymnosporangium Davisii** sp. nov.*

Telia chiefly epiphyllous, oval or oblong, 0.7–1 mm. broad, 1–2 mm. long, hemispherical, 0.5–1 mm. high, chocolate-brown, surrounded by the ruptured epidermis; teliospores 2-celled, broadly ellipsoid, 18–28 $\mu$ × 40–55 $\mu$, usually narrowed at the base, apex often attenuated, usually furnished with hyaline papillae 4–7 $\mu$ thick at the apex and often near the septum in each cell, slightly or not constricted at the septum; wall cinnamon-brown, 1–1.5 $\mu$ thick; pedicel hyaline, very long, 3–5 $\mu$ in diameter; germ pores one or two, apical or near the septum.

On *Juniperus sibirica* Burgsd. (*Juniperus nana* Willd., *Juniperus communis alpina* Gaud.) Wind Lake, Racine Co., Wisconsin, May 7, 1905 (type), May 22, 1904, *J. J. Davis*; Isle au Haut, Maine, September, 1903, *J. C. Arthur*.

There have been made in this country several collections of this small, inconspicuous form. It is very characteristic and unlike any other so far reported from this country. It occurs chiefly on the leaves, although it may be found sometimes on the smaller stems at the bases of the leaves. The finest specimens are those collected by Dr. J. J. Davis, of Racine, Wis., in the edge of a tamarack swamp near Wind Lake, Racine County, Wis. Unmistakable traces of the same form were found by Dr. J. C. Arthur of Purdue University at Isle au Haut, Maine, but owing to the lateness of the season, it being September when his search was made, no spore-masses remained on the leaves. The spores are readily distinguishable from all other American forms, now known, by the presence of hyaline papillae over the germ pores. In this respect they are very much like the form said to be culturally connected in Europe with *Roestelia cornuta* (Pers.) Fries. However, the American form both at Wind Lake and at Isle au Haut is reported by Drs. Davis and Arthur to be intimately

* Teliis plerumque epiphyllis, ovatis v. oblongis, 0.7–1 mm. latis, 1–2 mm. longis, hemisphaericis, 0.5–1 mm. altis, fusco-brunneis, epidermide rupta cinctis; teliosporis uniseptatis, late ellipsoideis, 18–28 $\mu$ × 40–55 $\mu$, basi plerumque angustatis, apice saepe attenuatis, apice et saepe juxta septum in quaque cellula papillis hyalinis 4–7 $\mu$ crassis praeditis, medio non v. vix constrictis; episporio cinnamomeo-brunneo, 1–1.5 crasso; pedicello hyalino, longissimo, 3–5 $\mu$ diam.; poris germinationis apice v. juxta septum singulis v. binis instructis.

In foliis ramulisque *Juniperi sibiricae* (*Juniperi nanae*), Wind Lake, Racine Co., Wisconsin, Maio 7, 1905, *J. J. Davis*.

associated with an aecial form on *Aronia*. This *Roestelia* on *Aronia* resembles in general appearance the *Roestelia cornuta* (Pers.) Fries on *Sorbus*, but a microscopical examination shows that it is morphologically distinct. This fact has assisted in arriving at the conclusion that the telial form under discussion is not identical with the one connected to *Roestelia cornuta* on *Sorbus* in Europe, and it is therefore characterized as a new species. It is hoped that cultures may soon be made which will give additional information. In the selection of a name the author has taken the opportunity to show his regard for the valuable services rendered to mycology by Dr. Davis and especially appreciation of his assistance in the study of this species. It may be added here that *Roestelia cornuta* on *Sorbus* occurs in this country but no telial form has ever been found associated with it.

**Gymnosporangium exiguum** sp. nov.*

Telia foliicolous, scattered irregularly, tongue-shaped or conical, small, 0.5–1 mm. thick, 1–1.5 mm. high, chestnut-brown; teliospores 2-celled, ellipsoid, 18–23 $\mu$ × 45–55 $\mu$, rounded or slightly narrowed both above and below, slightly or not constricted at the septum; wall cinnamon-brown, about 1.5 $\mu$ thick; pedicel hyaline, 5–6 $\mu$ in diameter, long; germ pores 2 in each cell near the septum.

On leaves of *Sabina virginiana* (L.) Antoine (*Juniperus virginiana* L.), Fredericksburg, Texas, March, 1895, *F. Grasso.*

On leaves of *Sabina sabinoides* (H.B.K.) Small (*Juniperus sabinoides* Sargent), Austin, Texas, March and April, 1901, *W. H. Long.*

This is a very delicate and inconspicuous species. It somewhat resembles *G. Nelsoni* but differs in its distribution on the host and in the shape of the sori. It differs from *G. inconspicuum* by having slender terete pedicels instead of inflated ones. There is at

* Teliis foliicolis, irregulariter dispositis, liguliformibus vel conoideis, parvis, 0.5–1 mm. crassis, 1–1.5 mm. altis, castaneo-brunneis; teliosporis uniseptatis, ellipsoideis, 18–23 $\mu$ × 45–55 $\mu$, apice et basi rotundatis vel interdum conico-angustatis, medio non vel vix constrictis; episporio cinnamomeo-brunneo, ca. 1.5 $\mu$ crasso; pedicello hyalino, 5–6 $\mu$ diam., longo; poris germinationis binis juxta septum instructis.

In foliis *Sabinae virginianae* (*Juniperi virginianae*) Fredericksburg, Texas, Mar. 1895, *F. Grasso.*

present no roestelial form recognized from this region which may be associated with this species.

**Gymnosporangium Libocedri** (Henn.) comb. nov.

In 1890 H. Mayr used the combination *Gymnosporangium Libocedri* in his work "Die Waldungen von Nordamerika" but he did not describe the fungus he referred to in such a way as to establish the name. In 1898 P. Hennings described in Hedwigia **37**: 271 a species of rust which he evidently took to be the same as the one Mayr had referred to but named it *Phragmidium Libocedri*. Sydow was the next to study the *Libocedrus* rusts and a full account of his observations is given in the Annales Mycologici **2**: 28. After considerable investigation he came to the conclusion that Hennings' name should be considered a synonym of Mayr's and that they referred to a species distinct from one that he had at hand which had been recently collected in California by E. B. Copeland. He therefore proposed the name *Gymnosporangium aurantiacum* for his species. Later on Sydow obtained some of Hennings' material and made out that the form described as *Phragmidium Libocedri* was identical with his *Gymnosporangium aurantiacum*. The writer has also examined original material of both these collections and finds this to be the case. The older specific name of the species is *Libocedri* and since Mayr's name is a *nomen nudum* there is nothing to prevent the combination *Gymnosporangium Libocedri* (Henn.) as here proposed. Sydow's specific name *aurantiacum* could not stand in any event as there is a *Gymnosporangium aurantiacum* of Chevallier, Fl. Env. Paris **1**: 424. 1826.

**Key to the telia**

Telia appearing on galls.
- Galls globoid or reniform.
  - Telia pulvinate, low, inconspicuous..... *Sabina barbadensis*, *Sabina bermudiana*, *Sabina virginiana* — *G. bermudianum* (Farl.) Earle. (Seym. & Earle, Econ. Fungi 249. 1893.)
  - Telia terete.
    - Telia cylindrical or cylindrical-acuminate, golden-brown... *Sabina virginiana* — *G. Juniperi-virginianae* Schwein. (Schr. Nat. Ges. Leipzig 1: 74. 1822.)

Telia somewhat conical, chestnut-brown.....*Sabina virginiana*....*G. floriforme* Thaxter.

Telia laterally compressed.

Telia thick, wedge-shaped, chestnut-brown..*Sabina virginiana* — *G. globosum* Farl. (Anniv. Mem. Boston Soc. Nat. Hist. 34. 1880.)

Telia thin, irregularly flattened, light chestnut-brown..... *Sabina utahensis*, *Sabina monosperma* — *G. durum* Kern. (Bull. Torrey Club 34: 460. 1907.)

Galls very irregular, usually elongated and knot-like (occasionally globoid) telia wedge-shaped, chestnut-brown.....*Sabina scopulorum* — *G. Betheli* Kern. (Bull. Torrey Club 34: 461. 1907.)

Telia appearing on gradual swellings of the branches.

Telia terete.

Telia stout, brownish yellow, spores 2-celled..... *Juniperus communis*, *Juniperus sibirica* — *G. clavariaeforme* (Jacq.) DC. (Fl. Fr. 2: 217. 1805.)

Telia slender, orange-yellow, spores 2–5-celled..... *Chamaecyparis thyoides* — *G. Ellisii* (Berk.) Farl (Ellis, N. Am. Fungi *271*. 1879.)

Telia cristiform, orange-yellow, spores 2–3-celled..... *Sabina utahensis*, *Sabina monosperma*, *Sabina pachyphlaea* — *G. speciosum* Peck. (Bot. Gaz. 3: 217. 1879.)

Telia hemispherical or applanate.

Telia chocolate-brown, spores 2-celled, pedicels terete.....*Juniperus sibirica* — *G. juniperinum* (L.) Mart. (Fl. Crypt. Erlang. 333. 1817.)

Telia orange-brown, spores 2-celled, pedicels carotiform..... *Sabina virginiana*, *Juniperus communis*, *Juniperus sibirica* — *G. germinale* (Schwein.) Kern.

Telia reddish brown, spores 2-celled, pedicels terete.....*Sabina virginiana* — *G. Nidus-avis* Thaxt. (Bull. Conn. Exper. Sta. 107: 3. 1891).

Telia chestnut-brown, spores 2–4-celled, pedicels terete..... *Chamaecyparis thyoides* — *G. Botryapites* (Schwein.) Kern.

Telia appearing on the young branches or leaves, with no, or only slight, enlargements.

Telia usually causing fasciation of the branches.

Telia reddish brown, spores 2-celled, pedicels terete..... *Sabina virginiana* — *G. Nidus-avis* Thaxt. (Bull. Conn. Exper. Sta. 107: 3. 1891.)

Telia cinnamon-brown, spores 2-celled, pedicels terete..... *Sabina scopulorum*, *Sabina pachyphlaea*, *Sabina virginiana* — *G. Nelsoni* Arth. (Bull. Torrey Club **28**: 665. 1901.)

Telia orange-yellow, spores 2–5-celled, pedicels terete *Chamaecyparis thyoides* — *G. Ellisii* (Berk.) Farl. (Ellis, N. Am. Fungi *271*. 1879.)

Telia chiefly on the leaves or green stems

Telia hemispherical, chocolate-brown, spores 2-celled..... *Juniperus sibirica*..... *G. Davisii* Kern.

Telia tongue-shaped, chestnut-brown, spores 2-celled..... *Sabina virginiana*, *Sabina sabinoides* — *G. exiguum* Kern.

Telia pulvinate, reddish brown

Teliospores 2–5-celled, pedicels terete..... *Libocedrus decurrens*... *G. Libocedri* (Henn.) Kern.

Teliospores 2-celled, pedicels carotiform..... *Sabina utahensis* — *G. inconspicuum* Kern. (Bull. Torr. Club. **34**: 463. 1907.)

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# INDEX TO AMERICAN BOTANICAL LITERATURE

## (1908)

The aim of this Index is to include all current botanical literature written by Americans, published in America, or based upon American material; the word America being used in its broadest sense.

Reviews, and papers which relate exclusively to forestry, agriculture, horticulture, manufactured products of vegetable origin, or laboratory methods are not included, and no attempt is made to index the literature of bacteriology. An occasional exception is made in favor of some paper appearing in an American periodical which is devoted wholly to botany. Reprints are not mentioned unless they differ from the original in some important particular. If users of the Index will call the attention of the editor to errors or omissions, their kindness will be appreciated.

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**Atkinson, G. F.** On the identity of *Polyporus applanatus* of Europe and America. Ann. Myc. **6**: 179–191. *pl. 2–4.* 31 Jl 1908.

**Blanchard, W. H.** On the identity of *Rubus canadensis.* Rhodora **10**: 117–121. 15 Au 1908.

**Brandegee, T. S.** Plants of Sinaloa. Zoe **5**: 243, 244. 5 Mr 1908.

**Brandegee, T. S.** New species of Mexican plants. Zoe **5**: 244–258. 5 Mr 1908; 259–262. 20 Ap 1908.

Many new species described.

**Clute, W. N.** On changes in function in dimorphic fronds. Fern Bull. **16**: 65–68. [S] 1908. [Illust.]

**Clute, W. N.** The check-list of North American fernworts. Fern Bull. **16**: 16–23. [Mr]; 51–57 [Je]; 81–83. [S] 1908.

**Cockerell, T. D. A.** Species and varieties. Torreya **8**: 194–197. 1 S 1908.

**Collins, F. S.** The genus *Pilinia.* Rhodora **10**: 122–127. *pl. 77.* 15 Au 1908.

*P. Lunatiae* and *P. Morsei* spp. nov.

**Collins, F. S.** Two new species of *Acrochaetium.* Rhodora **10**: 133–135. 10 S 1908.

*A. minimum* and *A. Hoytii* spp. nov.

**Dachnowski, A.** The toxic property of bog water and bog soil. Bot. Gaz. **46**: 130–146. *f. 1–6.* 22 Au 1908.

**Drummond, J. R.** *Agave Watsoni.* Curt. Bot. Mag. **4**: *pl. 8214.* S 1908.

**Eaton, A. A.** A question of nomenclature. Fern Bull. **16**: 77–79. [S] 1908.

**Edwards, A. M.** The upper Neocene deposit of Bacillaria around Boston, Massachusetts. Nuova Notar. **19**: 134–137. Jl 1908.

**Evans, A. W.** New West Indian Lejeuneae. Bull. Torrey Club **35**: 371–389. *pl. 26–28.* 26 Au 1908.
6 new species and the new genus *Leiolejeunea* described.

**Fernald, M. L.** Note on Michaux's *Vaccinium myrtilloides.* Rhodora **10**: 147, 148. 10 S 1908.

**Fernald, M. L.** *Draba aurea* in Rimouski County, Quebec. Rhodora **10**: 148. 10 S 1908.

**Fernald, M. L.** Preliminary lists of New England plants — XXI. *Cyperaceae.* Rhodora **10**: 135–144. 10 S 1908.

**Fletcher, E. F.** *Achillea tomentosa* at Westford, Massachusetts. Rhodora **10**: 127. 15 Au 1908.

**Foxworthy, F. W.** Lumbayao (*Tarrietia javanica* Blume). Philipp. Jour. Sci. **3**: 171–173. *pl. 1–3.* Jl 1908.

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